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Data Sheet

General Availability

MiTOP-E1/T1

SFP-Format TDM Pseudowire Gateway

- TDM circuit emulation over a packet switched network (PSN) with CESoPSN (RFC 5086), SAToP (RFC 4553) or HDLC (RFC-4618) payload encapsulation
- ASIC-based architecture for minimizing processing delay
- Differential and Advanced clock distribution mechanisms, including synchronous Ethernet (Sync-E)
- Configurable jitter buffer
- Support of Fractional E1/T1 with CAS
- Comprehensive OAM and performance monitoring

MiTOP-E1/T1 is a TDM pseudowire (PW) access gateway extending TDM-based services over packet-switched networks.

Housed in a Small Form-Factor Pluggable (SFP) enclosure, it is designed for quick and simple insertion into any 100/1000BaseFx Ethernet port with an MSA-compatible socket.

MiTOP-E1/T1 is a simple and cost-effective alternative to external, standalone gateways or conversion cards for each user device, saving on space, power consumption, cabling, and simplifying management.

TDM PSEUDOWIRE

The TDM port connects to any standard E1 or T1 device. E1 and T1 interfaces feature:

- G.703, G.704, framed and unframed modes
- SF and ESF framing (T1).

MiTOP-E1/T1 is transparent to all signaling protocols.

Note: *The Pseudowire conversion between the E1/T1 and the Ethernet side is done in a proprietary way so that MiTOP-E1/T1 has to work opposite another MiTOP device to convert back again to E1/T1 or opposite another RAD aggregation device (such as ETX-5 or IPmux-155).*

Pseudowire Performance

High-performance ASIC-based buffering and forwarding techniques minimize end-to-end processing delay.

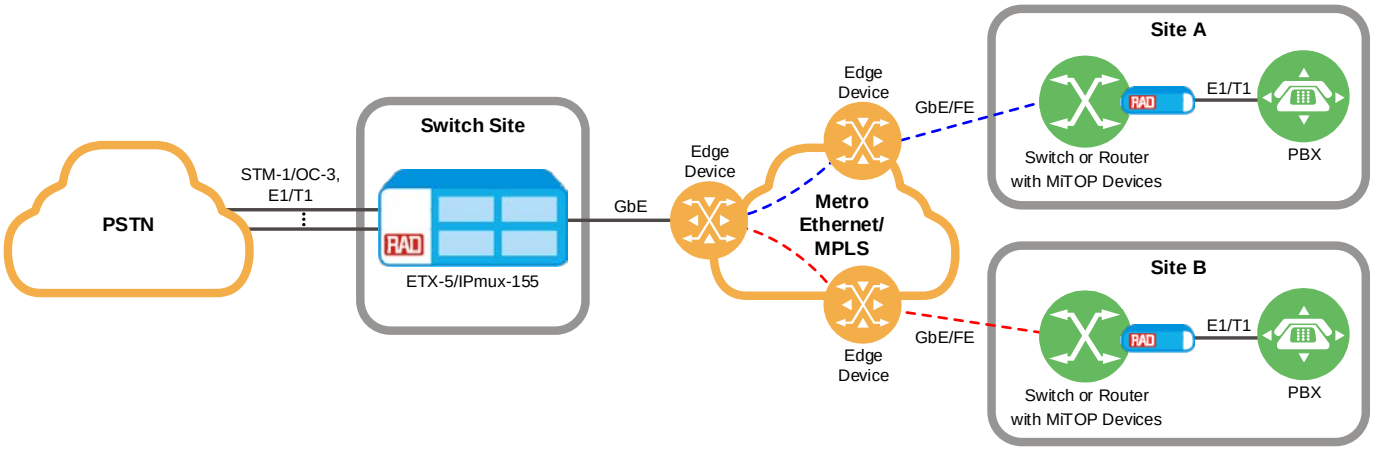

Figure 1. Aggregating TDM Services over PSN

Your Network's Edge®

MiTOP-E1/T1

SFP-Format TDM Pseudowire Gateway

The gateway provides a legacy over PSN solution for transmitting E1/T1 or fractional E1/T1 streams over packet switched networks. The device converts the data stream from its user E1/T1 ports into packets for transmission over the network. The addressing scheme of these packets is UDP/IP, MPLS or MEF. These packets are transmitted via a 100/1000BaseFx port of the host device to the PSN. A remote pseudowire gateway converts the packets back to TDM traffic.

MiTOP can transport up to 8 PWE (Pseudo-wire Emulation) bundles of digital signals (Fractional TDM or Fractional TDM with CAS) from a single physical interface to different network destinations. This cost-effective approach allows the user to start with a license for 2 PWEs for a later upgrade to 8 PWEs. Default configuration (a single PWE) is provided without license.

For easier deployment, MiTOP automatically learns a peer MAC address for MEF PW.

Configurable packet size balances between PSN throughput and delay.

Large configurable jitter buffer per each PW connection compensates for the delay variation introduced by the PSN.

The gateway supports the following encapsulation methods:

- Payload – CESoPSN, SAToP, HDLC
- Network – MPLS, MEF, UDP/IP.

Pseudowire QoS/CoS

For Ethernet networks – the outgoing pseudowire packets are assigned a dedicated VLAN ID according to 802.1Q and marked for priority using 802.1p bits. For IP networks – the outgoing pseudowire packets are marked for priority using ToS (including the DSCP and Diffserv bits).

For MPLS networks – the outgoing pseudowire packets are assigned to a specific MPLS tunnel and marked for priority using EXP bits.

OAM and Performance Monitoring

RAD's TDM PW OAM mechanism verifies connectivity and prevents pseudowire configuration mismatch.

The following RFC-2495 E1/T1 physical layer performance statistics are available: BES, ES, SES and UAS.

PW statistics interval time is configurable to match network requirements.

RESILIENCY

E1 or T1 loss of signal is propagated by sending an electrical LOS signal to the 100/1000BaseFx port, and is visually indicated by the LOS LED (red) turning on. This in turn can automatically turn off the LAN link. Turning on/off the packet link is user-configurable (enabled or disabled).

TIMING AND SYNCHRONIZATION

Synchronization between TDM devices is maintained by deploying advanced clock distribution mechanisms. The clocking options are:

- Internal – the master clock source for the TDM circuit is the internal oscillator
- Loopback – the transmit clock for the TDM circuit is derived from the E1/T1 port receive clock
- Adaptive – the clock from the TDM circuit is recovered from the PSN. Clock recovery conforms to G.823 using G.8261/G.8262-defined scenarios.

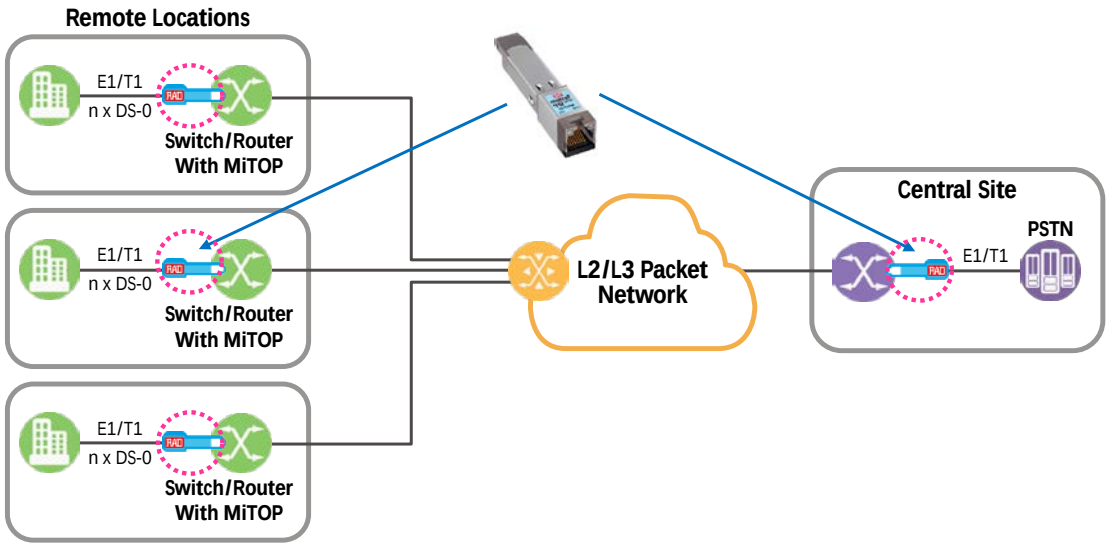

Figure 2. Aggregating TDM Services over PSN with MiTOP

MiTOP-E1/T1

SFP-Format TDM Pseudowire Gateway

- Sync-E (Gigabit Ethernet only) – Synchronous Ethernet timing is received via PSN and used to create a locked TDM clock. This ensures both sides of the network work with the same clock source.
- DCR (Differential Clock Recovery) – TDM clock frequencies are tuned to receive differential timing messages from the sending end to the receiving end.
- External – E1/T1 Tx clock is locked to an external clock source, such as DSL NTR timing.

Jitter and wander of the recovered clock are maintained at levels that conform to G.823/G.824 traffic. For adaptive clock recovery, the recovered clock performance depends on the packet network characteristics.

MANAGEMENT AND SECURITY

The units can be managed using different ports and applications:

- Out-of-band via I2C channel via the SFP edge connector
- Inband via the Ethernet port, using a Web browser
- SNMP v1 with limited trap support.

To facilitate integration of a new device into an IP network, if no IP address has been manually configured, MiTOP-E1/T1 automatically requests one from the DHCP server upon booting.

Management traffic can run over a dedicated VLAN.

Application software can be downloaded to MiTOP-E1/T1 via:

- SFP-CA.2 unit, using YMODEM protocol
- Central server, using TFTP.

ARCHITECTURE

Housed in a Small Form Factor Pluggable (SFP) package, MiTOP-E1/T1 complies with the Multi-Source Agreement.

Running on power derived from the host device, it requires no additional power supply.

MiTOP-E1/T1 is hot-swappable and features a special release mechanism for easy extraction from the SFP socket.

OPERATION AND MAINTENANCE

An optional configuration adapter (SFP-CA.2) is available for connecting MiTOP-E1/T1 to a PC via a USB 2.0 port. The configuration adapter is used for preliminary configuration or software download.

MONITORING AND DIAGNOSTICS

External and internal loopbacks can be used to check TDM link connectivity.

Alarms detected during operation are stored in a buffer holding up to 100 events.

TDM alarms of a connected device are forwarded to the peer side using the control word of the PW packet. Alarm Indication Signals (AIS) are sent to the connected TDM device if no PW packets are received or an L-bit Active packet is received.

Specifications

E1 INTERFACE

Number of Ports	1
Compliance	G.703, G.704, G.823, G.775, G732
Data Rate	2.048 Mbps
Line Code	HDB3, AMI
Jitter and Wander Performance	Per ITU-T G.823
Framing	Framed, unframed, multiframe; with or without CRC-4
Line Impedance	120W, balanced
Cable Type	UTP CAT-5
Cable Length	Up to 2500m (8202 ft) max, over 22 AWG wire
Connector	RJ-45

T1 INTERFACE

Number of Ports	1
Compliance	G.824, T1.403, G.703, G.823, T1-231, AT&T TR-62411, G.775

Figure 3. Delivering E1/T1 Services over PSN

MiTOP-E1/T1

SFP-Format TDM Pseudowire Gateway

Data Rate	1.544 Mbps
Line Code	B8ZS, AMI
Jitter and Wander Performance	Per AT&T TR-62411, ITU-T G.823, ITU-T G.824
Framing	Framed (ESF, D4), unframed
Line Impedance	100W, balanced
Cable Type	UTP CAT-5
Cable Length	Up to 1829m (6000 ft) max, over 22 AWG wire
Connector	RJ-45

ETHERNET INTERFACE

Type	100/1000BaseFx
Compliance	IEEE 802.3
Edge Connector	SFP-based, MSA-compliant

PSEUDOWIRE

Number of Connections	Up to 8
Compliance	CESoPSN: IETF RFC 5086
	SAToP: IETF RFC 4553
	HDLC: IETF RFC 4618
	MEF: MEF 8
Jitter Buffer Depth	E1: up to 256 ms
	Unframed T1: up to 340 ms
	Framed T1: up to 256 ms

DIAGNOSTICS

Indicators	LINK (green) – Ethernet link status
	LOS (red) – E1/T1 signal status

GENERAL

Environment

Temperature	MiTOP-E1/T1/FE: Ambient: -40° to 65°C (-40° to 149°F) Case: -40° to 80°C (-40° to 176°F)
	MiTOP-E1/T1/GE: Ambient: -40° to 60°C (-40° to 140°F) Case: -40° to 75°C (-40° to 167°F)
Humidity	up to 90%, non-condensing

Physical

Height	12.4 mm (0.49 in)
Width	14.0 mm (0.55 in)
Depth	74.1 mm (2.91 in)
Weight	30.0 g (1.0 oz)

Power

Power Supply	3.3V, up to 330 mA (Fast Ethernet)
	3.3V, up to 410 mA (Gigabit Ethernet)
Power Consumption	1.1W (Fast Ethernet)
	1.35W (Gigabit Ethernet)

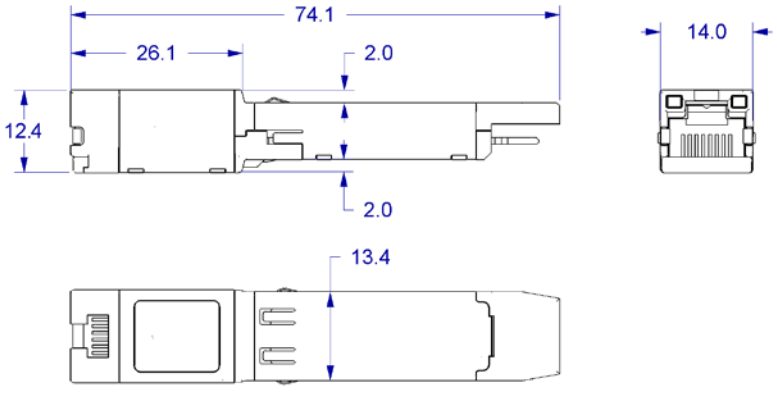

Figure 4. Physical Dimensions

MiTOP-E1/T1

SFP-Format TDM Pseudowire Gateway

Data Sheet

Ordering

RECOMMENDED CONFIGURATIONS

MiTOP-E1/T1/FE

SFP-format TDM pseudowire gateway, Fast Ethernet SFP port interface

MiTOP-E1/T1/GE

SFP-format TDM pseudowire gateway, 1000BaseT Ethernet user port

SPECIAL CONFIGURATIONS

Please contact your local RAD partner for additional configuration options

LICENSES

MITOP-E1T1-LIC/2PWE

License for 2 PWE tunnels

MITOP-E1T1-LIC/8PWE

License for 8 PWE tunnels

OPTIONAL ACCESSORIES

SFP-CA.2

Configuration adapter for connecting MiTOP-E1/T1 to a PC

International Headquarters
24 Raoul Wallenberg St., Tel Aviv 6971923, Israel
Tel 972-3-6458181 | Fax 972-3-7604732
Email **market@rad.com**

North American Headquarters
900 Corporate Drive, Mahwah, NJ 07430, USA
Tel 201-529-1100 | Toll Free: 800-444-7234 | Fax: 201-529-5777
Email **market@radusa.com**

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